

REMARKS

Applicant thanks the Examiner for the thorough consideration given the present application. Claims 1-11 are pending in the present application. Claims 1-10 were originally filed. New claim 11 recites additional features of the inventive combination of claim 1.

Claim Objection

The objection to claim 7 has been corrected. Specifically, the phrase, “a edge” on line 8 has been corrected to read, ---an edge---.

Rejections Under 35 U.S.C. § 103

Claims 1-4 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over *Koichi* (JP 09-205589) in view of *Shirakawa* (U.S. Patent No. 6,937,777). Applicant respectfully traverses this rejection. Claims 5-10 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over *Koichi* in view of *Shirakawa*, further in view of *Ochi* (U.S. Patent 4, 558,365). These rejections are respectfully traversed for the following reasons.

The present invention, as shown in Figs. 1-5, includes photo-sensors each having a higher-sensitivity photosensitive cell with a larger sensitive area and a lower-sensitivity photosensitive cell with a smaller sensitive area. The higher-sensitivity and lower-sensitivity photosensitive cells photoelectrically transduce the quantity of light incident to a corresponding electric drive signal. In response to the drive signals, the image sensor feeds pixel-by-pixel signal charges corresponding to the quantities of incident light to the preprocessor. The output of

the preprocessor is input to the ADC converting into a digital image signal. The digital image signal is input to the shading corrector. The shading corrector utilizes shading correction data to compensate for shading particular to the digital image signal, i.e. correcting unevenness in quantity of light incident to the photosensitive cells. More specifically, the shading corrector compensates for black and white shading incurred in the image signal by using shading correction data.

In the illustrative embodiment, the shading correction data are made up of correction data for correcting image signals from the higher-sensitivity photosensitive cells and correction data for correcting image signals from the lower-sensitivity photosensitive cells, respectively. For example, the high-sensitivity correction data are defined by a set of curves 172 (see FIG. 3) so that the curves 152, FIG. 3, are corrected to straight lines each corresponding to the maximum value around the center of the curve 152. On the other hand, the low-sensitivity correction data are defined by another set of curves 174 (see FIG. 4) so that the curves 154 involving the polarization 150 are corrected to straight lines each corresponding to the maximum value around the center of the polarization 150.

The *Koichi* reference discloses an image pickup device in which the dynamic range is expanded without generating fixed pattern noise resulting from unevenness of saturated charge amounts of each picture element. Each light receiving section is divided into two light receiving areas, one having a higher sensitivity than the other. The signal generated from the light receiving area with higher sensitivity is clipped and the resulting signal is added to a signal generated from the light receiving area with lower sensitivity to obtain a video signal output. As can be seen, the *Koichi* device is mainly for pattern noise reduction that has nothing to do with

shading correction as claimed in the present invention. More specifically, the Koichi reference does not teach or suggest a shading corrector having the first and second shading correction image data from the higher-sensitivity photosensitive cell and the lower-sensitivity photosensitive cell as claimed in claims 1-4.

The *Shirakawa* secondary reference disclosing an image sensing apparatus having a shading correction feature is cited to remedy the deficiencies of the *Koichi* device as mentioned above. However, Applicant respectfully submits that the *Shirakawa* device merely shows a conventional shading correction device for a conventional image pickup device having a uniform light receiving area. Specifically, the *Shirakawa* device does not utilize an image photo-sensor having both a lower sensitivity cell and a higher sensitivity cell per pixel. The present invention, as recited in independent claim 1, discloses a corrector executing shading correction on a first image signal derived from a first photosensitive cell in accordance with a shading characteristic of a first photosensitive cell, and a second image signal derived from a second photosensitive cell in accordance with a shading characteristic of a second photosensitive cell. The first and second photosensitive cells are contained within a single image photo-sensor representing a pixel. Thus, the *Shirakawa* device does not teach or reasonably suggest the shading characteristic of a first photosensitive cell and the shading characteristic of a second photosensitive cell for shading correction of each pixel. The shading correction device in *Shirakawa* makes a correction calculation of pixel data read out from each pixel of the image sensing element by extracting the shading correction coefficient associated with the corresponding pixel from the shading correction coefficients stored in the storage device (see column 4, lines 1-6). Accordingly, Applicant submits that the combination of the *Koichi* and *Shirakawa* references, as suggested by

Examiner, still does not disclose the invention as recited in claim 1. Accordingly, withdrawal of this rejection and allowance of this claim is respectfully requested.

Dependent claim 2 further defines the first and second shading correction data; dependent claims 3 and 4 further define the plurality of photo-sensors are arranged in a square matrix. These claims should be allowable at least by virtue of their dependency on claim 1.

In regards to dependent claims 5 and 6, Applicant respectfully submits that the addition of the *Ochi* reference still does not remedy the deficiencies of the *Koichi* and *Shirakawa* references as mentioned above. Thus, these claims should be allowable at least by virtue of their dependency on claim 1.

Dependent claim 7 recites, *inter alia*, a specific arrangement of the plurality of first and second photosensitive cells with respect to the center of the image frame. Specifically, the first photosensitive cells (higher sensitivity) are arranged closer to the center of the image frame, and the second photosensitive cells (lower sensitivity) are arranged farther away from the center of the image frame. See page 15, second paragraph, and Fig. 9 of the present specification. Applicant respectfully submits that none of the references cited, either singly or in combination, discloses such unique arrangement of the higher sensitivity cells and lower sensitivity cells of the photo-sensors. Accordingly, withdrawal of this rejection and allowance of this claim is respectfully requested.

Dependent claims 8-10 further recite, *inter alia*, the “third shading correction data”, and the “mixer mixing the first image signal with the second signal to produce a third image signal”,

respectively. Applicant respectfully submits that none of the references cited, either singly or in combination, discloses such features. Accordingly, withdrawal of this rejection and allowance of these claims is respectfully requested.

Applicant respectfully submits that Examiner's combination of *Koichi* and *Shirakawa* in regards to claims 1-4, and the combination of *Koichi*, *Shirakawa* and *Ochi* in regards to claims 5-8, is based on hindsight, using Applicant's disclosure as a blueprint, which is not permitted. *Interconnect Planning Corp.* 227 U.S.P.Q. 543.

New Claims

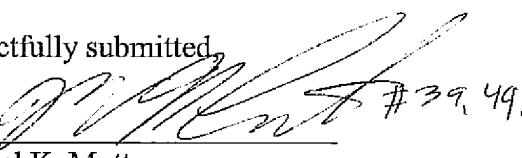
New claim 11 further defines the invention as recited in claim 1. Claim 11 emphasizes that the solid state image sensor of claim 1 compensates shading caused by image signals produced from each pixel where the second photosensitive area is smaller than the first photosensitive area. This further highlights the patentability of the inventive features already recited in claim 1.

CONCLUSION

In view of the above remarks, applicant believes the pending application is in condition for allowance. Thus, the Examiner is respectfully requested to reconsider the outstanding rejections and issue a Notice of Allowance in the present application.

However, should the Examiner believe that any outstanding matters remain in the present application, the Examiner is requested to contact Applicants' representative, Michael K. Mutter (Reg. No. 29,680) at the telephone number of the undersigned in order to discuss the application and expedite prosecution.

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Respectfully submitted,
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Attachments